BDM SUBCONTRACT FACT SHEET

CONTRACT TITLE: Characterization and Simulation of an Exhumed Fractured Petroleum Reservoir

ID NUMBER: G4S51734 **Related WA #:** 95-A01	**CONTRACT PERFORMANCE PERIOD** 03/29/1996 to 04/21/1998
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FUNDING (1000's)	BDM SHARE	OTHER SHARE	TOTAL
PRIOR FISCAL YRS	483	1,157	**1,640**
FISCAL YR 1998	267	0	**267**
FUTURE FUNDS	0	0	**0**
TOTAL EST'D FUNDS	**750**	**1,157**	**1,907**

PROJECT DESCRIPTION:

An excellent analog for a fault- and fracture-controlled oil reservoir has been identified. A detailed characterization of faulting and fracturing in this analog reservoir will be undertaken. The field data will then be used to constrain predictive models of fault and fracture distributions, geometries and fluid flow characteristics. These models will then be incorporated with numerical reservoir simulators to address production from fractured reservoirs and perform test of different production strategies. This work is supported by a subsurface database from a wildcat well and a high-resolution reflection seismic line contributed as a cost-share by our industry associate, Pioneer Oil & Gas.

Accomplishments:

An integrated understanding of the geologic/tectonic history of the analog fractured reservoir is largely complete. The analog, reservoir exhibits characteristic fracturing, veining and dissolution features that are likely to be found in producing reservoirs located in similar geologic settings. Studying the consequences of fluid flow using petrographic, trace element, and fluid inclusion methods reveals that oil migrated through the reservoir during and between each of the three periods of deformation identified in the study area. Thus, fractures and faults associated with each phase of deformation can be isolated and used to construct a series of analog reservoirs that exhibit characteristics associated with each period of deformation. More complicated reservoir analogs can be constructed by superimposing the consequences of successive deformation events. It will be valuable for reservoir geologists and engineers to experiment with the different fracture models developed in the project while attempting to construct appropriate permeability structures in producing reservoirs found in terrane that exhibit some or all of the characteristics found in the study area.

Preliminary models of reservoir-scale faults and interwell/wellbore-scale fracture networks indicate that the methodologies needed to create a final set of fracture models is almost in place. Once completed, a series of 3D fracture models will be available at the interwell/wellbore scales to illustrate how various factors control the character and intensity of fractures in a carbonate reservoir. In addition, the models provide a foundation for assessing the way that each model type might influence petroleum production from similar producing reservoirs.

A multiphase, discrete-fracture finite element model has been developed. The multiphase model developed in this study offers a true alternative to the conventional fractured reservoir simulation approach by explicitly accounting for realistic networks of discrete fractures. Finite element computations, particularly for these complex geometries and in multiphase is much more intensive computationally. The advanced numerical methods used and parallel implementation will make it possible to simulate more realistic fracture networks. Comparing the results from the discrete fracture model and the conventional approach will provide a preliminary comparison of the two distinct approaches used in simulating fractured reservoirs. A direct comparison of approaches also provides a basis for evaluating the ability of our homogenization method to provide reasonable porous media equivalent permeabilities for interwell- and reservoir-scale fluid flow simulation. The rigorous validity of each method, however, will have to be based on multiphase flow data through a well known fracture network.

A fully parallel, black-oil simulator with a number of advanced numerical schemes has been developed. The simulator is portable to other platforms, because a standard library (MPI) was used for parallelization. The next step would be to make the simulator available to run on a cluster of affordable machines. This would make advanced reservoir simulation technology available to small, independent producers. Comprehensive reservoir characterization activity may determine that it is important to represent portions of the reservoir at a fine scale, requiring a large number of grid blocks or elements. Parallel simulation will make it possible to execute the reservoir models resulting from such a fine-9 scale reservoir representation. This project has brought the technology one step closer to smaller, independent producers.